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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington D.C.

In the Matter of

Amendment of Parts 2, 21 and 94
of the Commission's Rules to
Accommodate Private
Microwave Systems in the 1.71-
1.85 GHz Band and in Bands Above
3 GHz

RM-7931

COMMENTS ON THE
UTC PETITION FOR RULE MAKING

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SUMMARY

SCS Mobilecom, Inc. strongly urges the Commission not to grant the Utilities Telecommunications Council's Petition for Rulemaking requesting that the Commission delay its ongoing spectrum allocation rulemaking in ET Docket No. 92-9 while it proceeds with a separate rulemaking proceeding to adopt rules for fixed microwave operations at the 4 and 6 GHz bands. SCS has established a personal communications service ("PCS") system -- Broadband Code Division Multiple Access ("B-CDMA") -- a spread spectrum system that can be implemented using the frequencies reallocated in ET Docket 92-9 without requiring existing fixed microwave users to migrate to other frequency bands. SCS' B-CDMA system has been carefully designed so that there is virtually no potential that PCS operations will cause interference to fixed microwave operations sharing the frequency band. SCS has also developed a means for microwave users to use B-CDMA spread spectrum technology to increase significantly the number of microwave stations that can operate in the shared frequency band. SCS' spectrum efficient B-CDMA PCS system thus permits full sharing of the targeted spectrum.

SCS recognizes UTC's legitimate concern that a suitable spectrum "home" be identified for fixed microwave users before they are compelled to move to other frequency bands. SCS' service proposal, however, eliminates the source of UTC's concerns. Therefore, there is no need at this time to suspend the Commission's spectrum allocation proceedings because PCS can be

implemented using services and technologies, such as SCS' B-CDMA system and perhaps other proposals incorporating sharing features, that do not require the immediate, wholesale migration of fixed users.

The Commission's spectrum allocation proceeding in ET Docket 92-9 is a crucial first step in permitting the rapid introduction of PCS in the United States. Immediate and efficient introduction of PCS will bring significant benefits to the U.S. economy and the American public. Clearly, PCS is critical for the United States to maintain the high quality and competitiveness of the U.S. telecommunications infrastructure as well as the U.S. telecommunications service and equipment manufacturing industry. In light of the significant public interest benefits of PCS and the capability of services like B-CDMA to avoid disruption to fixed users, the Commission should deny UTC's request to initiate ancillary rulemaking proceedings and defer action in ET Docket 92-9.

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COMMENTS OF SCS MOBILECOM, INC.

SCS Mobilecom, Inc. ("SCS") hereby submits its comments to the Petition for Rulemaking filed at the Commission on March 31, 1992, by the Utilities Telecommunications Council ("UTC"). In its Petition, UTC requests that the Commission (1) initiate a rulemaking to amend Parts 2, 21 and 94 of the Commission's Rules to provide for use of certain frequencies in the 2, 4, 6 and 10 GHz bands by private microwave systems, and (2) defer action in the Commission's ongoing rulemaking in which the Commission proposes to establish a spectrum reserve for emerging technologies such as personal communications services ("PCS"), see Notice of Proposed Rulemaking, ET Docket No. 92-9, FCC 92-20 (released February 7, 1992), pending the final outcome of this separate proceeding.

The Commission should not grant UTC's Petition. SCS strongly believes the public interest requires the Commission to proceed with its spectrum allocation rulemaking in ET Docket 92-0 as expeditiously as possible in order to bring PCS and other new

technologies to the American public as soon as possible. As discussed below, services such as SCS' broadband code division multiple access system ("B-CDMA") proposed for the 2 GHz band do not require immediate, wholesale displacement of microwave users thus making it possible for the Commission to proceed with Docket 92-9 while allaying UTC's stated concerns that fixed microwave users will suffer when their operations are cleared from the 2 GHz band to make way for the emerging technologies reserve band.

INTRODUCTION AND BACKGROUND

SCS is a leader in digital wireless telecommunications technology development. The Company has developed a unique broadband spread spectrum code division multiple access (B-CDMA) modem which allows extremely efficient use of the spectrum. SCS is currently licensing and negotiating licenses for wireless PBX, cordless phones as well as other telecommunications products for use in the ISM, Part 15 band.

UTC generally opposes the Commission's plan to use 2 GHz frequencies to establish a spectrum reserve for emerging technologies. According to UTC, utilities would be "severely hampered in their ability to provide vital public services if they were forced to vacate these bands without adequate replacement spectrum to which they would migrate their systems." Petition at 2. UTC asserts that the Commission's plan "will cause a severe and unjustified operational and financial impact on the nation's public

utilities, public safety organizations, railroads and petroleum industries." Id. Notwithstanding its overall objection to the Commission's proposal in Docket 92-9, UTC requests that the Commission initiate a rulemaking proceeding to address technical and coordination rules necessary to make additional spectrum available for (1) displaced 2 GHz users, (2) new or modified fixed microwave systems that, prior to the Commission's Notice in Docket 92-9, would have sought licensing in the 2 GHz band, and (3) new systems that may not be accommodated on other private microwave bands due to the displacement of the 2 GHz users.

SCS recognizes the legitimate concerns of existing fixed users that the creation of an emerging technologies band will substantially adversely affect their microwave operations if they are forced to migrate to other frequencies without adequate assurance that their new spectrum "home" will be suitable for private microwave operations. Based on that concern, UTC asks that a suitable "home" be found for private microwave users before they are asked to leave.

SCS' service proposal, however, eliminates the source of the UTC's concerns. As discussed herein, SCS's B-CDMA technology will allow microwave users to remain in their existing band and coexist with PCS and other B-CDMA technology users. Following SCS' proposal, fixed users could remain in their existing band and coexist with the B-CDMA technology users indefinitely. SCS' PCS

system also incorporates a Dynamic Channel Allocation ("DCA") monitoring system that provides added assurance that microwave users will not experience even minimal disruption from PCS services sharing the band.

Therefore, there is no need at this time to suspend the Commission's spectrum allocation proceedings because PCS can be implemented using services and technologies, such as SCS' B-CDMA system, that do not require the immediate or wholesale migration of existing microwave users to other spectrum bands and that can protect microwave users from interference. The full spectrum sharing features of such services thus eliminate the need to delay the Commission's emerging technologies docket. Since fixed microwave service users will not be required to move, the Commission should deny UTC's request for rulemaking and to defer action in Docket 92-9 pending those proceedings. UTC's Petition should therefore be dismissed.

1.0 THERE IS A NEED FOR ADDITIONAL SPECTRUM FOR PERSONAL COMMUNICATION SERVICES

As the Commission recognized in its Notice in Docket 92-9, there is a growing unmet demand for emerging technologies, including advanced PCS, that can provide the American public with unprecedented transmission quality, security and flexibility in communications. The proliferation of advanced wireless services and technologies promise to serve the public interest in ensuring

that the U.S. telecommunications infrastructure continues to offer to American users high quality, advanced services on a widespread basis, the U.S. telecommunications industry does not fall behind foreign firms, and U.S. industries benefitting from improved communications capabilities remain competitive in the global economy.

In particular, any major delay in the Docket 92-9 proceedings will contribute to the significant competitive handicap currently plaguing U.S. manufacturers. European and Asia manufacturers are already producing equipment to their own standards while American manufacturers, not knowing the frequency or bandwidths to be used, are "waiting in the wings."

The critical importance of fostering the rapid and efficient introduction of such services has been consistently acknowledged by the Commission, the Congress, and broad cross-section of the telecommunications industry. SCS fully concurs in this view and supports the Commission's diligent efforts to respond to the demand for such services and technologies. SCS accordingly urges the Commission to give high priority to the expeditious completion of the rulemaking and other regulatory processes that are necessary to implement such new services and technologies in this country.

In this vein, SCS submits that UTC's concerns raised in this Petition can be adequately addressed with a full understanding of

the capability of service and technology proposals, such as SCS' B-CDMA system, to permit full sharing of the targeted spectrum. In light of the compelling public interest benefits in proceeding to resolve spectrum and other implementation issues and the capability of existing service and technology plans like B-CDMA to alleviate disruption to existing spectrum users, the Commission should deny UTC's request to initiate ancillary rulemaking proceedings and defer action in Docket 92-9 in the interim.

1.1 Users Demand Wired Line Quality Voice, Wideband Data Rates and Wireless Convenience

Society today is more mobile than ever before. As a result, whether at home, in the office, or on vacation, Americans require access to mobile telephone systems having high quality voice and wideband data capability.

When cellular communications systems first became popular, people bought the systems because their need for flexible communications was so great, it overrode the poor quality and intermittent reception obtained from early cellular systems. Cordless telephones could have been a valuable asset in business settings as well as at home, except that the intermittent reception made business usage unacceptable. As people continued to use these systems their expectations increased: the total lack of privacy of cellular and cordless telephone systems became an issue as people realized that their telephone conversations could become public

knowledge. Consumers also started to demand the capacity for data transmission using their cellular and cordless phones to transmit computer modem and facsimile information.

Today, the public is not content with the wireless service currently available. As a result, a large market exists for a wireless telephone product having the capabilities of a wired telephone. This market need can only be met by the wide bandwidth afforded in the spectrum that the FCC proposes to set aside to encourage innovation in the use of new telecommunications technologies such as the personal Communications Service (PCS) proposed by SCS Mobilecom¹.

PCS will provide the user with a single service that can be used in and around the home, in lieu of the cordless phone; in the car, in lieu of the cellular phone; and in the office as part of a wireless PBX, in lieu of a PBX. The wireless PCS phone will have a capability of 10,000 codes (thus eliminating the potential for interference experienced using existing cordless phones due to blocked channels); it will have wired-line voice quality; and will be able to transmit data at rates up to those required for ISDN transmission. The transmission will be immune to fading so that calls will not be disconnected or have large bursts of errors.

¹See SCS' Request for Pioneer Preference, Filed May 4, 1992.

This service, which will compete with the cellular service currently available, will produce a competitive atmosphere, improving performance of all wireless services and significantly reducing the cost of a call. As a result this service will provide high quality, affordable communications for millions of Americans, many of whom do not currently have telephone service.

The technology needed to achieve this high level of performance in the PCS frequency band is Broadband-Code Division Multiple Access, ("B-CDMA").

1.2 1.85 GHz to 2.2 GHz is an Ideal Band for PCS

The Commission correctly selected the frequency bands of 1850-1990 MHz, 2110-2150 MHz and 2160-2200 MHz for emerging technologies.

The emerging technologies considered in the Commission's Notice of Proposed Rule Making require a wide bandwidth for efficient communications. This is particularly true for PCS since fading can be minimized efficiently only if the bandwidth employed is wider than the coherence bandwidth of the expected fade. SCS has performed numerous experiments and has demonstrated conclusively that the coherence bandwidth of an indoor fade is typically 6 MHz wide and almost never exceeds 10 MHz. Similarly, the coherence bandwidth of an outdoor fade is typically 4 MHz and, again, almost never exceeds 10 MHz. Thus, a communication signal

having a bandwidth of 40 MHz or more is unaffected by the fade while a signal having a bandwidth of 2 MHz or less is continually affected by fading, as are the current cellular and cordless telephones. Therefore, narrowband communication systems proposals will yield poorer quality communications and have a significantly lower capacity in a shared spectrum environment.

SCS' novel technology employs B-CDMA a direct sequence using the widest bandwidth allocated by the FCC. Using this approach fading is minimized so that the quality of a call can be significantly increased. In addition, B-CDMA uses the spectrum in a most efficient way, thereby maximizing the number of users/MHz/square mile.

2.0 SCS BROADBAND-CDMA: A SERVICE SOLUTION TO THE NEED FOR SPECTRUM

Broadband-Code Division Multiple Access (B-CDMA) is a system using direct sequence spread spectrum. Each user in this system transmits a signal containing its own unique binary code sequence. Further, each signal shares the same bandwidth.

Figure 2.1 illustrates how B-CDMA operates. Each phone transmitter contains a voice coder which converts voice waves into 1's and 0's of computer language. Each 1 or 0 is multiplied by a high frequency binary code sequence that is unique to a user, so that the base station can distinguish each user. The high

frequency code sequence spreads the bandwidth so that the resulting signal bandwidth greatly exceeds the coherence bandwidth of the fade. The signal is then modulated and transmitted. In the cell the signal is demodulated and despread to recover the original data signal.

Figure 2.2 shows the spectrum of the signal transmitted by the B-CDMA system. Figures 2.3 and 2.4 show the received spectrum when there is multipath. Notice that the multipath, represented by the "notches" in the spectrum, can be as wide as 10 MHz. B-CDMA operates properly in the multipath environment, with a fade margin of 1 - 3 dB, while TDMA, FDMA and narrowband-CDMA fail to operate without a fade margin of 30 dB or more.

2.1 BROADBAND-CDMA CAN EASE THE PAIN OF A TRANSITION

The Commission, in Paragraphs 22-26 of its NPRM² discussed a possible transition plan. The stated intent of the proposed transition plan is to accommodate the existing users of the targeted bandwidth in a most advantageous manner, one which is least disruptive to the public and most conducive to the introduction of new services needed today by millions of Americans.

SCS fully supports the Commission's public interest objectives in this regard and urges the Commission to continue to act on the

²Notice of Proposed Rulemaking, ET Docket No. 92-9, FCC 92-20 (released February 7, 1992).

spectrum reallocation and other issues raised by the introduction of emerging technologies as quickly as possible. To this end, SCS proposes a plan to allow a smooth introduction of new services during the transitioning of existing users from the PCS band. In particular, SCS has developed a plan to introduce B-CDMA PCS services in a way that allows existing users to coexist on the band if they desire to remain, with virtually no potential that PCS operations will cause interference to their operations.

2.2 B-CDMA Users Can Coexist With Microwave Users

SCS' Broadband-CDMA system is uniquely capable of permitting coexistence of PCS and the existing fixed service microwave users. SCS' B-CDMA system which permits sharing, based on SCS' advanced spread spectrum techniques rather than geographic separations, provides superior flexibility as well as efficiency.

Technologies and service proposals, such as SCS' B-CDMA plan, offer a valuable means for the Commission to introduce emerging technologies, including PCS, without the immediate or wholesale disruption of existing users. Although the Commission need not (and should not) rule on the merits of any particular PCS system at this time, the opportunities for full spectrum sharing made available by SCS' B-CDMA plan (and perhaps by the sharing features of other plans) are strong reasons for the Commission not to grant UTC's request to delay the spectrum allocation proceeding. Since the Commission can (and, in SCS' view, should) implement PCS using

spectrum from the emerging technologies reserve band without disturbing existing users, contrary to UTC's position, there is no critical need at this time for the Commission to move backwards by delaying the spectrum allocation proceeding while it launches a separate rulemaking proceeding to adopt new technical rules for the 4 GHz and 6 GHz bands.

Further, in Sec. 2.2 we describe a spread spectrum microwave system that will allow the microwave users to remain on the band indefinitely.

2.2.1 Coexistence in a B-CDMA System: Minimal Limitation on User Density

Using SCS' B-CDMA, coexistence means that the PCS users and the point-to-point fixed service microwave users can use the same frequency band without either system noticeably interfering with the other system. In the case of the PCS system, degradation of quality, such as "noisy" speech or increased "outage-time" (an extremely common occurrence in the current cellular systems) would represent such a lack of coexistence. For the fixed service microwave users, EIA Document 10E defines the maximum allowable interference for digital and analog microwave systems.

In order to determine the maximum interference allowable by PCS users, a microwave transmitter is powered down until the received signal to noise ratio measured at the fixed microwave

receiver is 30 dB (Typically this requires the transmitted microwave signal to be attenuated by 40-50 dB). Then the PCS interfering power can be increased. However, following Document 10E the maximum PCS interference must be 6 dB below the thermal noise level of the microwave receiver. Clearly, such a restrictive requirement limits the capacity of the B-CDMA system.

Based on SCS' testing and thorough analysis, SCS has determined that in a B-CDMA/fixed microwave, shared environment, microwave operators may experience fades of 40-50 dB for an average of 20 seconds a year. (There are 37 million seconds a year). To put the slight magnitude of this potential interference problem in perspective, it is interesting to note that in New York the electric power generated by Con Edison or LILCO is cut-off for far more than 20 seconds a year without disastrous consequences.

If, during the 20 seconds period, a PCS user is in the boresight of the microwave antenna, and this PCS user does not suffer the same fade, then during 20 seconds a year, coexistence will not be possible.

Thus, it is SCS' contention that using the SCS B-CDMA system, the probability of a PCS user causing a fixed service microwave receiver to suffer excessive interference is extremely small.

2.2.2 Dynamic Capacity Allocation is an Added Safeguard That Insures No Excessive Interference to Microwave Users

SCS Mobilecom recognizes that the fixed service microwave user community is concerned that on rare occasions an excess of PCS users, located in a cell near a microwave receiver, might cause interference in excess of that permitted by Document 10E. To address this possibility, SCS' proposed B-CDMA system employs Dynamic Capacity Allocation³ (DCA) to regulate the PCS user density, based on the performance of the fixed service microwave receiver. Significantly, SCS' unique DCA feature provides unequalled assurance to microwave users that PCS operators sharing the band will not interfere with or otherwise disrupt these operators.

Dynamic Capacity Allocation is a monitoring (sensing) system which can be placed at each microwave receiver site. This simple sensor system is then connected using a dedicated line to the PCS base stations(s) within the relevant vicinity. The DCA monitoring system continually monitors the state of the microwave receiver to determine its fade margin (i.e., the extent of interfering signals) and continually relays this information, via the dedicated line, to the PCS base stations. The DCA system is designed so that as the fade margin decreases, the PCS base station automatically limits the amount of PCS transmissions on that base station and can shed load. In a sense, the cell size becomes "elastic".

³Patent Pending.

In this manner, the capacity of the PCS base stations is dynamically controlled by the tolerable signal-to-noise ratio (SNR) or error rate of the fixed service microwave receiver. The result is that the fixed service microwave user is guaranteed that excessive interference will not occur⁴.

2.3 B-CDMA Microwave Systems Can be Used by Microwave Users to Further Reduce the Potential for Interference and to Increase the Number of Microwave Users in the Proposed Frequency Band

The number of fixed service microwave users operating in a square mile of a city is insignificant when compared to the number of expected PCS users in that same square mile. Indeed, millions of Americans need, and are waiting for, an affordable, high quality PCS service. If the fixed microwave users used B-CDMA microwave systems they would be significantly less affected by the PCS user.

To illustrate this point consider a fixed service microwave user transmitting at the rate of 43 Mb/s. This is equivalent to 650, 32 kb/s PCS users operating using quadrature PSK modulation. If we assume a microwave user density of 1 microwave receiver/square mile, the effective fixed service microwave user density is therefore equivalent to 650 PCS users/sq. mile.

⁴Dynamic Capacity Allocation is SCS' response to the very real concern expressed by Senator E. Hollings in his April 6, 1992 letter to FCC Chairman A. Sikes.

If we now consider a B-CDMA PCS system having a processing gain of 750, such a system has the capacity to simultaneously service more than 60,000, 32 kb/s PCS users/sq. mile. Thus, the microwave users, if employing SCS' B-CDMA spread spectrum microwave system⁵, would use only about 1% of the entire systems capacity.

Thus, if the fixed microwave users changed their microwave system to a B-CDMA microwave system, their traffic would represent only 1% of the total capacity of a PCS system. Hence, not only could the fixed microwave user remain on its existing frequency band, additional microwave users could be added to the band.

3.0 CONCLUSION

In conclusion, SCS rejects the UTC contention that the FCC should not proceed with Docket 92-9 until it addresses the technical and coordination rules that they contend are required as a result of Docket 92-9.

Our reasons for this rejection are:

- (1) Any delay in the establishment of new frequencies that can eventually be used for PCS puts the U.S.A. at a further disadvantage economically with respect to the rest of the world where PCS frequencies have already been allocated. In an information dependent, market based

⁵Patent Pending.

society people demand the ability to communicate using the most efficient, advanced, flexible (and affordable) services possible and UTC's Petition, if granted, will delay this needed communication significantly.

- (2) Any delay in Docket 92-9 will place U.S. manufacturers at an increased disadvantage compared to firms in Europe and Asia. Overseas manufacturers are already building equipment to their own standards, while American manufacturers, not knowing the frequency or bandwidths to be allocated are "waiting in the wing".
- (3) The PCS users will not interfere with the microwave users if Dynamic Capacity Allocation is used. Thus, the UTC's legitimate concern that PCS might cause excessive interference is eliminated.
- (4) The microwave users can increase the number of stations if they employed the spectrally efficient B-CDMA spread spectrum microwave system proposed by SCS. If the typical density is 1 microwave user/sq. mile which as seen in Sec. 3.2 corresponds to approximately 1% of the PCS capacity, then the microwave user density could be increased by a factor of 10 to about 10% of the PCS capacity through the use of B-CDMA spread spectrum microwave systems and still leave a PCS capacity of more

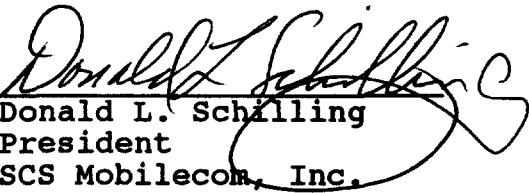
than 50,000 PCS users/sq. mile.

Since microwave users need not leave the band to make room for an emerging technologies band and can expand (at a rate far in excess of the expansion rate seen until now) there is no reason to grant the UTC Petition and to delay the rulemaking proceedings in ET Docket No. 92-9.

Respectfully Submitted

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HOW CODE DIVISION MULTIPLE ACCESS WORKS

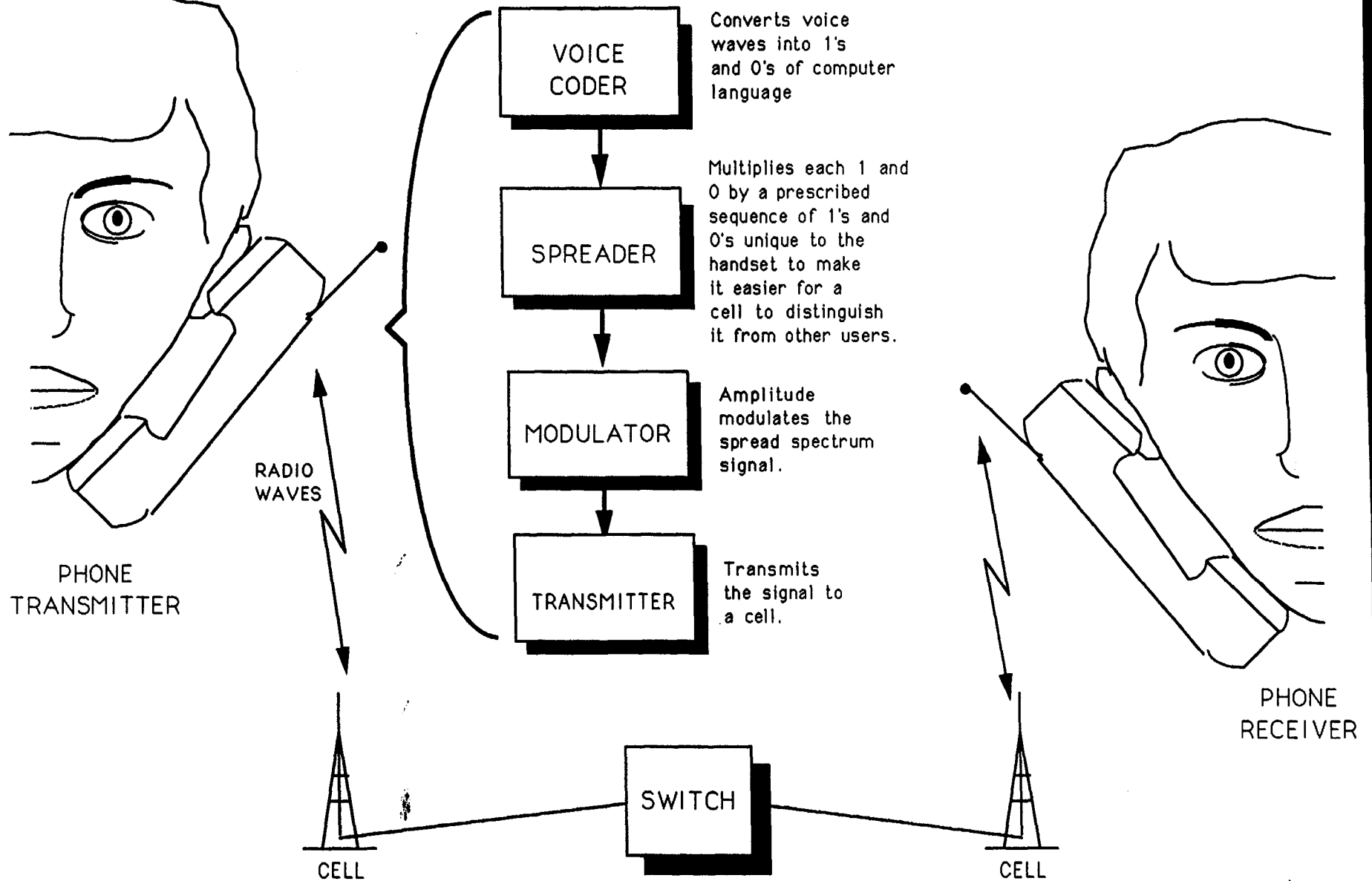
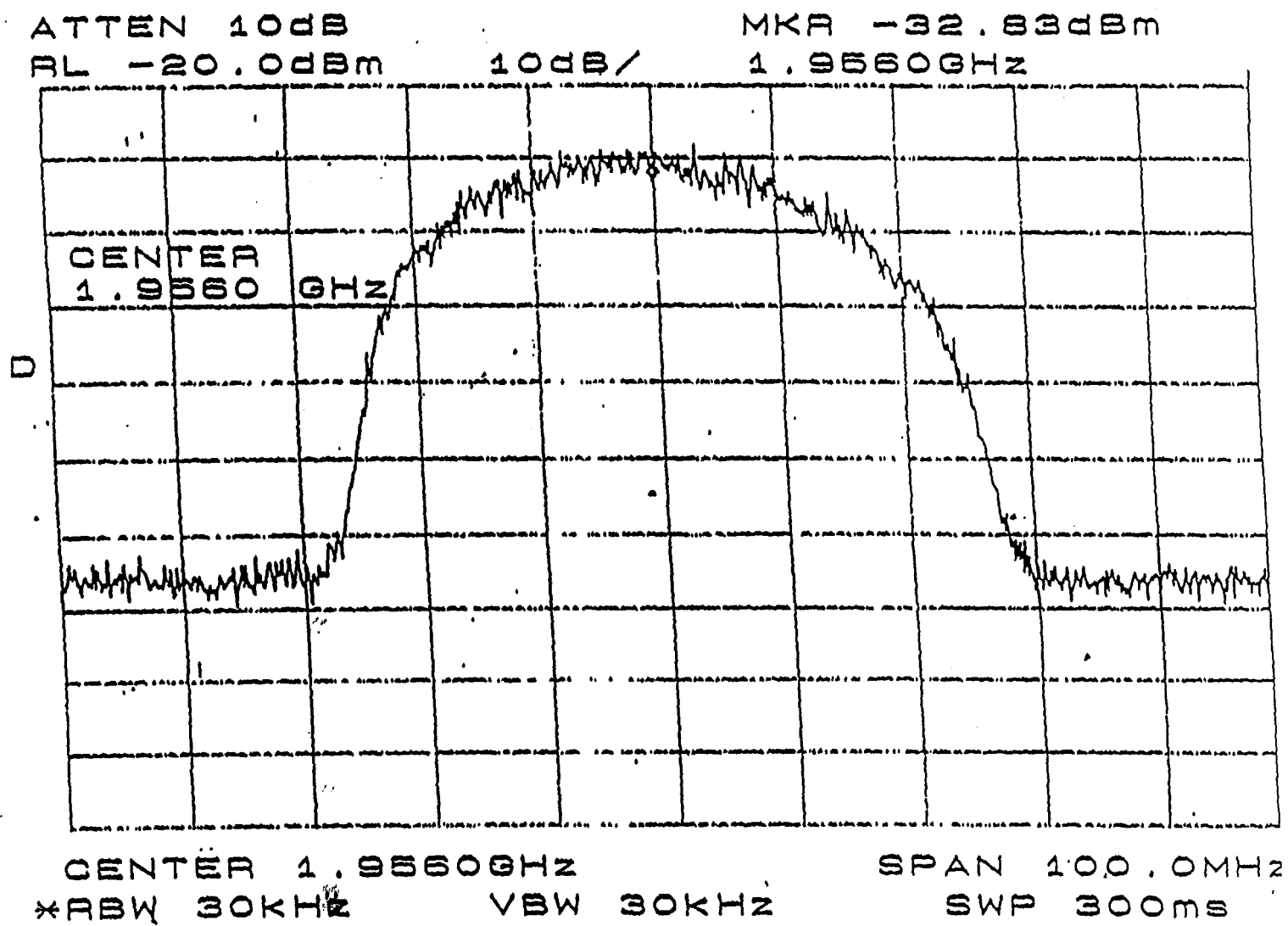
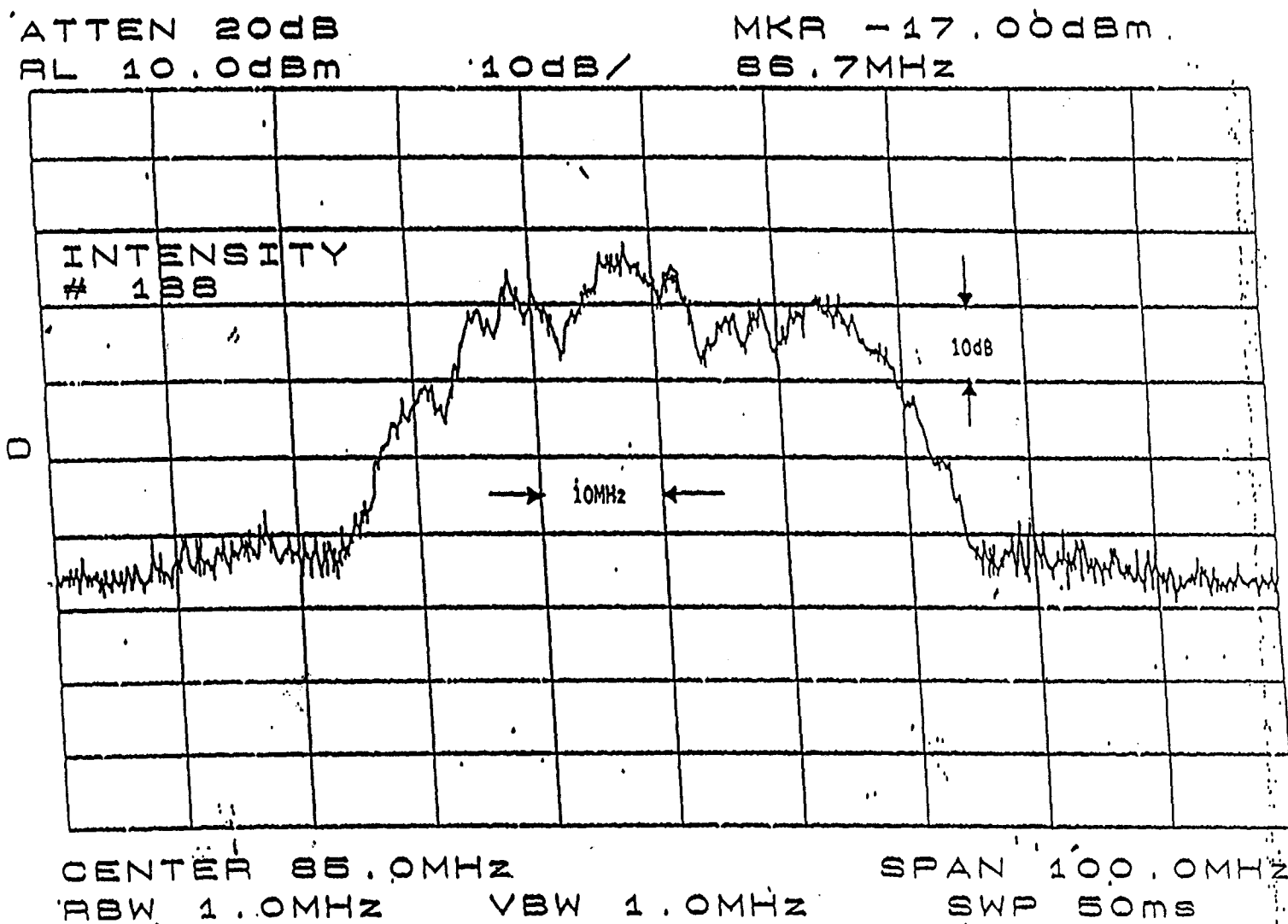


FIGURE 2.1



**FIGURE 2.2**



SPECTRUM ANALYZER PLOT, SITE #6, RECEIVER RF MONITOR

FIGURE 2.3

COURTYARD OF THE WTC

